Journal of the Society of Arts.

FRIDAY, FEBRUARY 15, 1867.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at Eight o'Clock :—

FEBRUARY 20.—"On the Water Supply of London as it affects the Interests of the Consumers." By THOMAS BEGGS, Esq.

FEBRUARY 27.—"On the Economy of Telegraphy as part of a Public System of Postal Communication." By EDWIN CHADWICK, Esq., C.B.

MARCH 6.—The following subject for Discussion will be introduced by Mr. CHRISTOPHER COOKE:—"On Storm Signals and Forecasts, their utility and public importance with respect to Navigation and Commerce."

CANTOR LECTURES.

A course of Six Lectures "On Pottery and Porcelain," illustrated by specimens of various manufactures, and by photographs and diagrams, is now being delivered by William Chaffers, Esq.

LECTURE V.—MONDAY, FEBRUARY 18.

EUROPEAN PORCELAIN. — Italy, Germany, France, Holland, Belgium, Russia, Poland, &c.

LECTURE VI.—MONDAY, FEBRUARY 25.

ENGLISH POTTERY AND PORCELAIN.—Early History, continued to the beginning of the 19th century.

The lectures commence each evening at eight o'clock, and are open to members, each of whom has the privilege of introducing one friend to each lecture. Tickets for this purpose have been issued to each member.

ART-WORKMANSHIP COMPETITION.

The Department of Science and Art has purchased, for the South Kensington Museum, the following articles, for which prizes had been awarded in the recent Art-workmanship competition :—

5. Flowers carved in Caen Stone, by W. H. Holmes, 101, Dean-street, Soho, W. Price £5.—(*Prize* of £5.)

15. REPOUSSÉ WORK IN METAL.—Executed in iron, after the Martelli bronze mirror case at South Kensington, by G. Page, 39, Duglas-street, Northampton-road, Clerkenwell, E.C. Price £20. —(1st *Prize* of £10; also, North London Exhibition *Prize*.*)

28. HAMMERED WORK IN IRON.—By George Hobbs, 4, Marlboro'-mews, Blenheim-street, W. Price £5 10s. (*Prize* of £2.)

30*a*. Ditto, Panel for a screen, by W. Letheren, Lansdown Iron Works, Cheltenham. Price £20.—(*Prize* of £10.)

31. "Autumn," Female Head in satin wood, by G. F. Bridge, 3, Vincent-square, S.W. Price £5 10s. —(*Prize* of £5.)

* This Prize consists of the interest of £167 7s. 3d. Consols, invested in the name of the Society of Arts, to be awarded by the Council "for the best specimen of skilled workmanship" at the Society's Exhibition.

The works sent in competition for these Prizes are now placed in the Society's Great Room for the inspection of members and their friends.

EXAMINATIONS, 1867.

In addition to the prizes announced in the Programme of Examinations, the following are offered :—

The Worshipful Company of Coach and Coach Harness Makers offer a prize of £3 in Freehand Drawing, and a prize of £2 in Practical Mechanics, to the candidates who, being employed in the coachmaking trade, obtain the highest number of marks, with a certificate, in those subjects respectively.

The Worshipful Company of Goldsmiths offer three prizes—of £5, £3, and £2 respectively—to the three candidates who, being employed on works in the precious metals in any part of the United Kingdom, shall obtain from the examiners the first, second, and next highest number of marks, such prizes to be distinguished as the "Goldsmiths' Company's Prizes."

INSTITUTIONS.

The following Institutions have been received into Union since the last announcement :—

Alderley Edge Educational Institute.
Galgate (Lancaster) Mechanics' Institution.

MEMORIALS OF EMINENT MEN.

The Society's Committee for marking by memorial tablets the spots which are interesting as connected with eminent men or historical events, have made a commencement of this work. A tablet, marking the house were Byron was born, has been attached to No. 24, Holles-street, Cavendish-square, by permission of the occupiers, Messrs. Boosey and Co.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

FOOD COMMITTEE.

A meeting of this committee took place on Saturday, the 9th instant, at eleven o'clock; the Right Hon. Henry Austin Bruce, M.P., in the chair. There were also present—Professor Robert Bentley; Messrs. W. H. Bodkin, Assistant-Judge; Harry Chester; Hugh C. E. Childers, M.P.; Rev. W. L. Clay; Lord De Lisle and Dudley; Messrs. William Hawes, C. Wren Hoskyns, Francis S. Powell, M.P.; Clare

Sewell Read, M.P.; G. Sclater-Booth, M.P.; Benjamin Shaw, Thomas Twining, James T. Ware, and Edward Wilson.

The Secretary having read the minutes of the last meeting,

The CHAIRMAN said that the able and comprehensive address which was made to them at their last meeting, by Mr. Chester, would enable him to dispense with the necessity of addressing them again upon the subjects then dealt with. He thought he might assume that they were familiar with the objects for which the committee had been formed. He would therefore address himself at once to the practical points—how and by what means they could best organise themselves so as to attain most rapidly and effectively the objects for which they were constituted? These objects, broadly stated, were the supply of additional food to the people, and the better use of those supplies which they already possessed. The former subject embraced the supply of meat and of cereals from abroad, but more especially of meat—and when he said meat, he did not mean live cattle, because he thought they might very well trust to the interests now occupied with that trade. It was one which had increased rapidly—one which recent circumstances had tended greatly to augment; and as communications on the Continent by railway increased, and greater facilities for transit were afforded, there could be no question that, to some considerable extent, there would be an increase in the supply of cattle. But there was another question, which could not be left entirely to the management of traders, and that was those operations into which science so largely entered —namely, the supply of preserved meat, and of the essence of meat—a question which had already occupied the public attention, but as to which, he thought, no very great progress had hitherto been made. Now, it seemed to him, that they might most usefully form a sub-committee, specially to address itself to that subject—the supply of preserved meat and of the essence of meat from foreign countries. It might be, perhaps, as well to entrust the same sub-committee with the question, also, of considering what supply of cereals and other edibles could be got as well as meat; but in the first instance he would rather suggest that that sub-committee be requested to apply itself particularly to the branch of the subject he had just indicated. Then came the question as regarded home supplies. In his opinion, by far the most important parts of this question were those specially indicated by Mr. Chester, the supply of milk and fish, and the spread of juster ideas of cookery than now prevailed among our working classes. As to the supply of milk, it was notorious that it was inadequate, not only in the metropolis, but everywhere, even in the most strictly rural districts. The importance of that supply to the health of our population could not be exaggerated, and therefore he thought that by itself might occupy the attention of another sub-committee. Another question, of much inferior importance, but one of deeply national and growing interest, was the supply of fish. Recent disclosures had shown that here was a field open to considerable improvement; and he did not doubt that if the attention of a few intelligent, determined men were applied to that subject, there might be a very great advance made in that respect. Perhaps the largest and most difficult question of all to deal with was that of what might be called national dietetics—the actual food used by the people, and their mode of cooking it. There were few of them who had not had opportunities of inquiring into this matter. He might say, in passing, with respect to certain classes of the population, that he (the Chairman) had some opportunities of studying this subject during the two years he served upon the Mining Commission, when that was made a part of the inquiry. The ignorance which prevailed as to the proper use of food among the working classes of this country was very great. Probably in this matter they were among the most backward in Europe, certainly they were the most wasteful; and, great as the evil was, it seemed to him that greater still was the difficulty of dealing with it, because we had to do with the settled habits, and often with the fixed prejudices of the people. But the difficulty of a question was no reason why they should not attempt to grapple with it, and he hoped they would be determined to exert themselves by every means to extend knowledge in this direction, and to remove that ignorance which all allowed to be a great evil. He had already indicated sufficient employment for four sub-committees, and he did not think that at present it would be well to appoint a larger number. There was another point, however, which he thought well worthy the attention of this Committee, and that was what steps should be taken with respect to the remedying of a crying evil, namely, the frauds that were committed, both as to the weight and quality of the goods sold, especially against the poor. It seemed to him that that was a subject ripe for legislation. The Committee had already communicated with the Home Office to ask for certain returns which would throw light on this subject—returns as to the number of prosecutions that had been instituted under the law, which, with respect to false weights, was certainly inadequate. The offence was, perhaps, sufficiently clearly defined, but the punishment was altogether insufficient, and he saw no reason why the present Session should pass without a Bill being introduced into Parliament for remedying that evil. It might, therefore, be advantageous to combine a few legal gentlemen and members of Parliament into a sub-committee, for the special purpose of considering that subject. These matters were far from exhausting the whole question, which indeed was almost boundless, but he thought that they should limit themselves, in the first instance at least, to the most important branches of the inquiry, particularly those indicated by Mr. Chester in his opening address. What they had to do that morning was to divide the Committee into sub-committees, choosing the members with reference to their special fitness for investigating the different subjects of inquiry. He would, therefore, propose at once to the consideration of the Committee that they should take their first step by determining what the number of sub-committees should be, and then by dividing themselves into those sub-committees. A very comprehensive circular had been prepared, which it was proposed to send to any person supposed to possess special knowledge on any of these questions. If any suggestion could be made for its improvement, he should be very happy to hear it.

Mr. C. S. READ, M.P., said that, with respect to the transit of dead meat, very much good might be done by a simple inquiry into the matter. It was generally supposed that the offal of meat killed in the country could not be sent up to town. The idea might arise, perhaps, from the prejudice or the interests of certain people in the trade. If attention were directed to this matter by the Committee some valuable information might be obtained.

Mr. CHANDOS WREN HOSKYNS said, with reference to the supply of milk, it was mentioned in the address of the President of the Royal Agricultural Society, at the beginning of the year, that the quantity of milk sent up to the metropolis from different parts of the country amounted to something like seven million gallons annually. It was also stated that this milk came from distances varying from between seven miles and two hundred miles,—that there were parts of the country, two hundred miles off, where the occupiers found it their interest to send up milk to the metropolis, but there were other parts, less than fifty miles distant, where attention had never been called to this supply, and by the mere publication of this fact some good might be done.

The CHAIRMAN said he quite agreed with Mr. Read,

that all the information that reached them last year in Parliament showed that one of the objections to killing at a distance was that a great deal of the offal of the meat, which would be bought by the poorest of the people, did not reach the metropolis, and did not find a market in the place where the cattle were slaughtered. That seemed to be a subject that might very well be considered. Another matter for consideration was whether a larger area might not be obtained from which to draw a supply of milk for the metropolis. It must be remembered, however, that they were not dealing with the interests of the metropolis alone, but with the supplies of the whole of the population. The Council should first get accurate information, and then propagate it, so as to make the farmers understand that they were not only backward in the question of the supply of education to their workmen, but also in the supply of that which was so necessary to the health of their children—milk.

Mr. EDWARD WILSON said, looking over the programme, which had been very carefully drawn up by the sub-committee, he began to feel rather appalled at the wideness of the scope of the inquiry. Probably the best mode of dealing with the matter would be through the agency of sub-committees; but viewing the committee as it at present existed, it seemed to him that if they did not materially increase the number of members they would not be able to appoint many sub-committees. With regard to another question—the establishment of cheap dining-rooms—the success of Mr. Corbet at Glasgow was well known, and was an illustration of what could be done by singleness of purpose and energy. He (Mr. Wilson) would be very glad to join any set of gentlemen, to whom the question of profit was not an object, to see if something practical could not be done in London in this direction.

Mr. SCLATER-BOOTH, M.P., said that, with regard to the subject of fraudulent weights and measures, he believed that in the course of a few weeks a bill would be prepared and introduced, strengthening the law in respect to adulterations and frauds. A small sub-committee on this subject might, therefore, be useful. With regard to the milk question, he might say that the subject of the disposal of the sewage was very appropriate to that investigation, and should not be lost sight of in considering it.

Professor BENTLEY thought that four sub-committees would be too many. He would propose that the first three subjects, which were the most important, should be grouped together under one sub-committee, who would thus deal with the animal kingdom. The fourth and fifth would occupy a second sub-committee, who would deal with the vegetable kingdom, and also with the subject of beverages. Then the sixth and seventh subjects—dietaries, &c.—would naturally come under a third sub-committee. As to the last subject—adulteration—he thought it would be utterly impossible to do anything with a bill on that question this session; and his impression was that it would come far better at the end of the inquiry, when a vast amount of valuable information had been collected by the sub-committees.

The CHAIRMAN thought the subject of meat should be separated from those of milk and fish. He agreed that the question of adulteration was a very large one, and would require a great amount of preparation, but the subject of fraud was very pressing, and influenced enormously the daily comforts of the people, and he thought this might be dealt with very rapidly.

Mr. CHESTER thought the subject of adulteration a most important one, and hoped the Committee would be able to do something to stay the increasing tide of fraud in the commercial transactions connected with the supply of food. He thought when they had collected a sufficient amount of information to enable them to proceed, as to the police regulations of foreign countries as well as our own, they might, perhaps, have a paper read by a gentleman now present, and thus they might have some very advantageous denunciations of the evils which existed put forth from this Society. There might be also a bill brought into Parliament. There were several members of the House of Commons present, who, he had no doubt, would take an active part in the matter. It would not be a party question, and thus, he thought, if properly prepared, it would pass without difficulty.

Mr. SHAW thought the number of sub-committees should not be too large, or there would be a difficulty in working them. He was rather for not pressing the matter with regard to adulteration at first. If they could get working committees on meat, and on milk and fish, he thought they would really do a great deal. As regarded the improvement of cookery, that seemed to him a subsequent question; it would be better to have the facts brought out by the other committees first as to the supply of food. With reference to the question of the supply of meat, they must recollect that they had now in this country, for a short time, Mr. Parish, the Consul at Buenos Ayres, and if they could get matters forward while he was here, they would be able to tell him fully what they required, and then he would go back to his consulship, and do much good in promoting the supply.

Mr. F. S. POWELL, M.P., suggested that as to the question of fish, some of the members of the Commission lately sitting in Paris might be able to give them some very valuable information. He had received a letter from the Professor of Chemistry at Cambridge, which touched upon a question it might be worth while for the Committee to look into—namely, the quantity of fish which was rejected by fishermen as not being valuable.

Mr. SHAW moved—"That one sub-committee be appointed to inquire into the question of meat, and another to inquire into those of milk and fish." This, after some discussion, was carried, the sub-committees being constituted as follows:—

MEAT.—Right Hon. H. Austin Bruce, M.P., Messrs. H. Chester, H. C. E. Childers, M.P., C. Wren Hoskyns, W. H. Michael, F. Parish, C. Sewell Read, M.P., Benjamin Shaw, T. Twining, James T. Ware, and E. Wilson.

MILK AND FISH.—Lord De L'Isle and Dudley, Lord Robert Montagu, M.P., Right Hon. H. Austin Bruce, M.P., Messrs. H. Chester, and C. Sewell Read, M.P.; in addition to whom Messrs. James Caird, P. McLagan, M.P., H. S. Thompson, and J. C. Morton were to be asked to join.

The Sub-Committee on Meat met at 10.30 on Wednesday. Present—The Right Hon. H. A. Bruce, M.P., in the chair; Messrs. C. S. Read, M.P., E. Wilson, F. Parish, B. Shaw, H. Chester, and J. T. Ware. The Committee, after discussing the course which their proceedings should take, directed the Secretary to bring before them at their next meeting specimens of the various methods of meat preservation.

CANTOR LECTURES.

"ON POTTERY AND PORCELAIN." BY W. CHAFFERS, ESQ.

LECTURE IV.—MONDAY, FEB. 12.

German Pottery and Oriental Porcelain.

The lecture commenced with a description of the two sorts of earthenware made in Germany—fayence and grès, or stoneware, and their properties were defined. In speaking of Nuremberg, the lecturer said the most celebrated potter was Veit Hirschvogel, of Schelestadt, born in 1441, and died in 1552 (contemporary with Luca della Robbia, of Florence), who settled here about 1470. These early specimens are somewhat like the maiolica of Italy, but the colours are brighter—the

green predominating in most of the specimens; figures in relief in niches are frequently seen on vases; and many tiles of the sixteenth century, which formed portions of stoves and chimney-pieces, are still in existence, and were referred to. The stoneware of Germany is well known throughout Europe; its durability for domestic purposes, and the elegant character of its ornamentation in relief, caused it to be sought for everywhere. The grès de Cologne was especially esteemed, and is often confounded with the grès de Flanders, which latter name is given indiscriminately to all the stoneware of Germany, notwithstanding the German inscriptions upon the vessels, and the arms of German cities moulded upon them; an erroneous nomenclature which ought to be rectified. The finest specimens are clearly traceable to Germany—probably to Cologne. The ware was made in moulds, and usually dated from 1550 to about 1687. Buntzlau, Harburgh, and Grenzhausen, were also noticed, and Creussen, in Bavaria, where the earthenware jugs (with the apostles ranged round them in relief) were made. Teylingen, in Holland, is celebrated in ceramic history from its association with the unfortunate Jacqueline, Countess of Hainault, and the manufacture of an earthenware cruche, called, after her, "Jacoba Kaunebje." This princess was wife of John Duke of Brabant, and after many severe trials she retired, 1433, to the Chateau of Teylingen. While here (according to the tradition) she employed her leisure in superintending the manufacture of cruches, which were thrown into the moat of the chateau, that in after ages they might be considered works of antiquity. This ware is of common quality, without any ornamentation. The *Jacoba Kaunebje* figured by Marryat, in his history of pottery, is actually a superb Cologne ware canette, with designs in relief, and nearly two centuries later in date. The next manufactory of importance was Delft, celebrated at an early period for its enamelled fayence. It was probably about the time of the introduction of Chinese porcelain into Europe that the Delft potteries sprang into active existence, and no examples are known of an earlier date than 1530. The importance of the manufacture went on increasing throughout the 16th century, but the commencement of the 17th century witnessed its greatest development. At that time there were nearly fifty fabriques in full work at Delft. In the middle of the 18th century they were reduced to twenty-four, yet making a considerable quantity of pottery. At the present day, of all this number only one remains, and its productions are of a very inferior character. Mr. Chaffers described the varied forms of Delft ware, and, among other curious efforts of the potters, some violins and other musical instruments. In introducing the subject of Chinese porcelain, the early and extravagant myths were briefly adverted to, being mixed up with historical facts. The Chinese historians attribute the first discovery of the secrets of the ceramic art to the reign of Hoang-ti, 2,698 years before our era. This pottery was a sort of hard stone ware. The true porcelain was not invented until about 185 B.C., sixteen hundred years before it was known to the western nations of the globe. The word *pourcelaine* has existed in the French language since the 14th century, long before the introduction of China ware into Europe, and it was then applied to mother-of-pearl, and not to porcelain in our present acceptation of the term, but, from a certain similarity, it became in the 16th century generally so called. The Chinese kept the composition of porcelain a profound secret, and endeavoured to deceive travellers by all manner of wonderful tales; one of these strange conjectures being, that it was nothing more than a mass composed of plaster, eggs, shells of marine locusts, and other similar compounds, which, being well mixed together, was hidden secretly under ground, where it remained 80 years, and was left as a valuable heir-loom by the Chinese to their descendants as being of greater value than gold. There are numerous manufactories of porcelain in China, and the lecturer described the most important of them, the fabrique of King-te-tchin, established in the sixth century, and taken under imperial patronage in A.D. 1004. The city contains more than a million of souls. The expense of procuring materials must have been considerable, for the wood for the furnaces had to be taken a hundred leagues, and provisions were dear, yet all could here find employment. The young and old, the lame, and the blind could earn a livelihood by grinding colours, or in other ways. In 1700 there were nearly 3,000 furnaces constantly burning, which presented at night the appearance of a town on fire. After a very interesting account of King-te-tchin, the lecturer concluded by stating that it was now a heap of ruins. In the course of the recent disturbances which have convulsed the country, the Taepings sacked and pillaged the imperial manufactory, destroying all the kilns and workshops, giving a fatal and irrecoverable blow to this particular industry in China. The porcelain tower of Nankin was built in 1403-1424, by the Emperor Yong-lo, on the site of an earlier structure of other materials. It is not, therefore, so ancient as generally supposed. The tower was octagonal, and consisted of nine stages, elevated on a pedestal of the same form—261 feet high. It was built of brick, encased with tiles of porcelain, the quality of the ware being equal to that of which the ordinary vessels are composed. Each stage had a projecting cornice, and at every angle a bell, eighty in all; when agitated by the wind they produced a sound which, at a short distance, might have been taken for an Eolian harp. The Emperor Khang-hi visited it in 1664, and caused it to be repaired. This structure has recently been completely demolished by the Taepings, and not a fragment is left to mark the site of this once celebrated monument. The various monsters which are found upon the ware and the deities were explained. The dragon, emblematical of imperial dignity, is provided with five claws. Princes of lower rank bear the same dragon with four claws; others only three; while the mandarins are only allowed a serpent with four claws, called *mang*. The Khylin and the Dog of Fo were exemplified by specimens, and other symbolical animals referred to. The porcelain of China is composed of two earths, the one a decomposed feltspathic rock, called *kaolin*, and the other a rock of the same geological origin, mixed with quartz, called *petuntse*. There being a perfect identity between these elements, they both harmonize so completely that they have an equally resisting power when placed in the kiln. The *kaolin* used in making this porcelain is much softer than *petuntse* when dug out of the quarry, but it is this which, by its mixture with the other, gives strength and firmness to the work. It is by a modification of the glaze, so as to render it more or less expansive when submitted to the heat of the kiln, that the well-known variety called *crackle* is produced. The porcelain made and decorated at King-te-tchin is not known of an earlier period than the commencement of the fourteenth century. The vases of the Hong-wou period, 1368-1398, and those of Yong-lo, 1403-1424, are generally rude in design and of imperfect fabrication. Under Siouen-te, 1426-1436, a vast improvement is perceptible. These are frequently met with. The best period, however, of Chinese art is the *Tching-hoa*, which continued from 1436 to 1487. The most ancient mode of decoration was the blue camaieu, and it is still much esteemed in China. On this blue ware Chinese characters are frequently found denoting the period in which they were made. Few of the ancient pieces painted in colours are marked, and it is therefore difficult to tell even their approximate date, especially as there was a conventional mode of decoration which had been practised from time immemorial; the painters worked according to given models or patterns, and the same uncouth and rude designs were placed, through successive ages, upon the ware.

Mr. Chaffers, by the aid of diagrams and examples, clearly explained the means by which the dates or periods could be deciphered with certainty. They usually consist of six marks, the two first express the dynasty, the two next the period, and the two last signify "made during," like our expression *fecit*. Characters, in a square seal form, were used from the commencement of the 18th century, either stamped or stencilled in red. Mr. Chaffers explained the manner of deciphering these characters, so as to tell the exact date; they are the same meaning as the others, but made angular instead of curvilinear, to suit the squareness of the seal. In speaking of the curiosities of porcelain, he exhibited some cups, with an outer reticulated covering, completely insulated from the inner vessel, except at the rims at top and bottom, where it is joined. These were used for tea or hot liquids, and can be held in the hand with impunity, notwithstanding the heat enclosed. Another variety consists in cutting or punching out pieces of the paste or body of the ware in patterns before it is baked; it is afterwards dipped in glaze, which fills up the holes. The pattern, being much more transparent than the body of the ware, is distinctly seen when held to the light. Others were made with movable bands, in such a manner that although separate they cannot be altogether removed from the piece. The wonder is that in the baking, the edges in juxtaposition should not have become cemented together. Other curiosities were shown, as the "Cup of Tantalus," puzzle-jugs and teapots, swimming tortoises, &c. The porcelain of Japan was fully described. Its discovery took place about 27 B.C., but it was not until 1211-1221 that it was fully developed. The porcelain is very much like that of China, but the colours are more brilliant on the fine pieces, of a better finish, and the designs more of the European character, the flowers being more natural and the monsters less hideous; the paste is of better quality, and the glaze a purer white, especially in the 17th and 18th centuries. The beautiful egg-shell porcelain was spoken of, and specimens of ancient and modern manufacture were shown—some covered with bamboo threads woven together with wonderful precision. The Japanese excel in a particular fabrication which is almost peculiar to them—the lac, usually called Lac Japan. It is a resinous gum, which exudes from certain trees, especially the *Rhus vernix*. This varnish is applied by them to a great variety of materials, and is sometimes inlaid with mother-of-pearl in landscapes and flowers, birds, &c. The usual colours are red, brown, and black, of different shades, and gold is used upon it with effect. Lac was frequently applied to porcelain vases, either entirely covering the surface or only partially in relief.

Some specimens of the Satsuma porcelain were exhibited, brought to this country by the English officers engaged in its bombardment some years since. Also some china made in India, painted with Hindu deities. The table was filled with a choice collection of specimens of German stoneware and Oriental porcelain, kindly lent to the lecturer, to illustrate his remarks, by Mr. H. G. Bohn, Dr. Diamond, Mr. Durrant, and Mr. Wareham.

TENTH ORDINARY MEETING.

Wednesday, February 13th, 1867; WILLIAM HAWES, Esq., Vice-President of the Society, in the chair.

The following candidates were proposed for election as members of the Society:—

Brand, Henderson William, 5A, Courland-grove, S.
Chaffin, Matthew Henry, 18, Hart-street, Bloomsbury, W.C.
Fowler, John R., 1, Mitre-court-buildings, Temple, E.C.
Green, John, 7, Sherborne-street, N.
Harrington, G. H., 5, Billiter-square, E.C.
Harrison, Frederic, 7, New-square, Lincoln's-inn, W.C.
Hayes, Robert, 1, Pembridge-square, Bayswater, W.
Hoff, Edward, Carpet Manufactory, Louth.
Hopkinson, John, York-place, Oxford-street, Manchester.
Isaac, S., 2, Hyde-park-gate, W.
King, Edmund, 1, Elvaston-place, Queen's-gate, W.
Layton, James, The Wilderness, Baldock.
Lee, Richard, 39, Lothbury, E.C.
Loughborough, Thomas, 23, Austin-friars, E.C., and Selwood-lodge, Tulse-hill, S.
Macintosh, William, 24, Paternoster-row, E.C.
Phillips, Henry Louis, 32, New Broad-street, E.C.

The following candidates were balloted for, and duly elected members of the Society:—

Atkins, Francis Henry, 62, Fleet-street, E.C.
Barlow, James, Greenthorn, near Bolton.
Burgess, A. W., 107, Strand, W.C.
Chaffer, Thomas, 14, Great Howard-street, Liverpool.
Greenwood, Thomas, 28, Waterloo-road, Cheetham, Manchester.
Hayes, Henry, 31, College-green, Dublin.
Richardson, William, Hartford Works, Oldham.
Whitehead, Peter Ormerod, Rawtenstall.

The Paper read was—

ON ARTIFICIAL ILLUMINATION.

BY D. N. DEFRIES, ESQ.

The advantages and importance of artificial illumination are too obvious to need any remarks from me; nor need I dwell on its history from the period of early civilisation down to the present time; how a splinter of fir or kernel of a nut might have been resorted to for the purpose. Accident, probably, soon taught mankind that the resinous exudations of trees, the fat of animals, and the bitumen and naphtha of the mineral kingdom might be made available; and we are all familiar with the torch, the candle, and the infinite variety of lamps for the burning of fat or oil.

It is very probable that the earliest lamps were made of no set form, but that the fat or oil was placed in any convenient vessel and burnt by means of a bundle of rushes, dried moss or decayed vegetables.

As civilization advanced attention would naturally be directed to the form best suited for the object sought. The lamp—at first but little more than a circular vessel containing a combustible material—was gradually developed into the artistic forms of the ancient Greeks, and in our own times has received the improved appliances which science has enabled the moderns to adapt to it. At a very early period it must have been observed that when an attempt was made to enlarge the wick beyond a certain point the flame became dull and smoky. To remedy this it was customary to split the wick, so as to divide it into a number of smaller flames, each of which would allow the atmosphere freely to circulate round it so as to keep up tolerably good combustion. In 1780, Argand made the first great step in advance, and, by means of cylindrical wicks, supplied air for combustion to the inside as well as the outside of the flame. All the subsequent improvements of this invention have been made with a view of adjusting the wick, and directing the current of atmospheric air into the body of the flame. The first was accomplished by means of a rack and pinion, the second by various forms of fountains and syphons; and in the Carcel or moderator lamp by means of a piston and pressure from a spring. Count Rumford invented the reservoir, and Parker placed the oil above the level of the flame. For the combustion of volatile oils and naphtha, lamps of very different construction are required, and great care had to be taken to secure a due and regulated supply of air to the flame, and contrivances for preventing the heat from volatilising these liquids became necessary. These are the invention of

several well-known men, amongst whom the names of Beale, Holliday, Luderstoff, Keir, and Young may be mentioned.

The "Bude" light of Mr. Gurney is only an extension of the principle of the Argand lamp, in which, in the place of atmospheric air, a jet of pure oxygen is passed into the centre of the flame, and by this means the combustion and light are greatly increased; but, in consequence of the complicated nature of the apparatus and the careful attention necessary in its management, it has never come into general use.

Before leaving the subject of lamps, I may be permitted to observe that the "Paraffine" lamp, when properly constructed and used with the best kind of paraffine oil or petroleum, is an excellent and economical means of illumination, and, with careful attention, is perfectly safe; but, on the other hand, if bad oil is used and the lamp overheated, explosions may occur.

It would take too much time for me to speak of all the materials used in the manufacture of candles, and the manipulation is so well known that I need not describe it. We are all familiar with the history of coal gas, so largely used now both in private houses and for the illumination of public buildings and our streets. The mode of manufacture and its purification have been so often described and are to be found in so many printed treatises, that I should not be justified in entering upon them now.

To relate to you the progress of gas—Murdoch's first application of it to lighting purposes, down to the efforts of Winsor, and the formation of the "Chartered Gas Company," and subsequently down to the present time—would be repeating an oft-told tale. The number of gas companies now in existence will, I think, be sufficient to show that the prejudice which at first existed against gas light is now overcome. But, notwithstanding that the subject is generally familiar, and although gas is so largely used, yet the public are but little acquainted with the methods adopted for burning it, and what burners are specially adapted for the various purposes for which the light is intended. The burning of gas has gone through nearly as many phases as the burning of the various other materials to which I have alluded, from the rude and simple pipe or orifice, whence the gas issues with combustion as imperfect as that of the original torch—and bearing indeed a great resemblance to it—down to the carefully-adjusted jets and their uniform variety of one supply of air. The flaring lights of our butchers' shops, with their enormous consumption of gas, are the types of the one; the fish-tail, the argand, and the sun-light, which after all is but a variety of the fish-tail, are types of the other.

Scarcely anything connected with the subject of gas illumination has commanded more attention than the means whereby gas may be burnt to the best advantage; and although the greatest ingenuity has been displayed, yet none of the arrangements possess that universal applicability for which they have been, in most cases, so highly vaunted. The reason of this is obvious; different kinds of gas require different forms of burner in order to effect perfect combustion. As a rule it may be stated, that the rich cannel gases are best consumed from burners with fine apertures, while the poorer gases are burnt with most advantage from larger apertures. Again, in the former case, provision should be made for a large supply of atmospheric air, as by spreading out the flame by means of an internal button, or by using tall glasses, whereas, in the latter case, the opposite condition should be observed. It is manifest, therefore, that no single burner can be constructed so as to secure both these requirements, and consequently that any burner which is well suited for one kind of gas is altogether unfit for the other. The most prominent gas burners in general use are as follows:—The simple jet, which is produced from a burner pierced with a single hole. This mode of consuming gas is not considered to be cleanly or economical, and, except for certain purposes of illumination, where we wish to produce some kind of device, is rarely employed. The "cockspur" burner is a burner with three or more jets radiating off from it, and burning separately. The light from such a burner is only equal to the sum of the individual jets, for, as they do not coalesce, they cannot in any way assist each other. It is one of the worst burners that can be employed. The "fish-tail" burner is the result of two small jets of flame impinging upon each other under a certain pressure. Probably, though so common in its use, it is but little known how the pure flat leaf of flame is produced in the fish-tail burner. The jet, instead of one perforation, has two, which meet at their exit, and the streams of gas as they issue impinge on each other, and thus spread out into that flat flame which is so familiar to us all. The "bat's wing" burner is so named on account of the shape of the flame. It is one of the oldest forms of gas burners; it is constructed with a fine slit, instead of two holes, for the exit of gas, and the flame is broader and not so high as the fish-tail. These burners are easily managed, and on this account are generally supplied to the public lamps.

The "sun burner" is a cluster of "fish-tail" burners placed round a common axis, and spreading out in a horizontal direction, so as to produce the figure of a flower, or of the sun. This burner is so constructed that the products of combustion are carried out of the room by means of a ventilating funnel and tube placed directly over it. In most cases the sun burner consists of seven clusters of nine fish-tails each. The burners are supplied with gas from a descending pipe, which branches to each cluster, and surrounding the whole is a sheet-iron cone, with a tube attached to the top, for carrying off the products of combustion. In this tube there is placed a butterfly-valve, for the purpose of regulating the current of air, so that the draughts may not be too great, and the lights may burn in a horizontal direction. Around the cone are placed other iron cases, which not only serve for ventilation, but also insulate the inner cone, and, by their cooling effect, prevent the intense heat of the latter from being communicated to the woodwork of the ceiling. These cylinders are not connected with each other or the cone, and therefore distinct currents of air pass between each of them; such is the cooling effect of these currents, that while the cone is hot, the two outside cases are of the same temperature as the atmosphere of the room. On the upper part of the cylinders there is an inverted cone, with a pipe passing trough the ceiling and roof, protected on the outside by a wind-guard, which allows the hot air and products of combustion to escape.

The "Argand" burner produces a flame which is exactly like that of an ordinary Argand oil lamp. The burner consists of a circular disc of iron, pierced with a number of holes. It is hollow in the middle, for the purpose of allowing a supply of air to the interior of the flame; and the jets of gas coalesce, so as to form a hollow cylindrical flame. A glass chimney is placed round the burner, in order that the supply of atmospheric air may be copious and steady. The number of holes, or jets, varies from ten to thirty for ordinary gas, and from thirty to ninety for cannel. In the former case the holes are comparatively large, and in the latter they are very small, as in the case of the fish-tail burner. Several patents have been taken out during the last few years for improvements in this form of burner; they have chiefly been directed to the lessening of the shadow which is cast by the ring and body of the apparatus. Leslie's Argand is constructed to allow a current of air to pass up between each of the jets, and so destroy, to a certain extent, the continuity of the flame. This is effected by a number of small tubes, which rise to an inch or so above the ring which supports them. These tubes are made to converge a little as they advance upwards, thus forming a truncated cone. The glasses are constructed so as to deflect the air into the flame; and

they are of different heights in order that they may be suited to different amounts of consumption.

I will now draw your attention to some of the processes for carburetting, as it is termed, that is, supplying to the gas before it is burnt the vapour of some volatile hydro-carbon, so as to increase its illuminating power.

Many inventions have been proposed for increasing the brilliancy of coal gas, and at the same time for rendering it more economical and innocuous. One was to pass the gas through an apparatus where a large surface of a liquid rich in carbon was exposed. This acted very well for a short time, the gas taking up large quantities of the hydro-carbon vapour; but the more volatile portion of this being consumed first, and only the heavier and less volatile liquid being left behind, it necessarily yielded less and less vapour, and the gas became poorer until it ceased to be in any degree improved. Besides this, the tarry and watery vapours were condensed in the interior of the apparatus, and rendered it after some time useless. Many forms of carburettors have been devised for getting rid of these difficulties, with more or less success. I refer to those invented by Woodward, Carless and Blagden, Saul and Armstrong, the Photogenic Gas Company, and others. The latest which I have seen is one invented and patented by Mr. Welch, wherein the reservoir is placed at the upper part, from which, by a simple arrangement, the liquid descends only as required to maintain the proper supply of vapour. This is brought about by the pressure of the gas itself, all floats being dispensed with. To prevent the apparatus from being obstructed by tarry and watery vapours, a chamber is placed at the bottom in which these are condensed, and they can be drawn off through a plug placed there for that purpose. The "carburettor" requires no attention beyond refilling periodically, the diminution of the intensity of the light showing when that operation is necessary.

There are certain illuminating agents which do not vitiate the air of the room; only two of these I shall mention this evening. The oxy-hydrogen, or "Drummond light," and the "electric light." The oxy-hydrogen light was first introduced to public notice by Lieutenant Drummond. It consists, as is well known, of a jet of oxygen and hydrogen gases which is projected under great pressure upon a cylinder of lime. The high temperature which is thus produced renders the earthy body so incandescent as to be intensely luminous. Another mode of obtaining this light is to throw a jet of oxygen into a flame of spirits of wine or ether, or mix the oxygen with coal gas instead of pure hydrogen. The electric light is produced as follows:—The electricity is conveyed from the battery by wires which should be of large size, so as to conduct it with ease, and should be covered with gutta-percha, so as to insulate them. Light may be obtained from the battery in two ways, either by bringing the poles into contact with a yard or so of platinum or iridium wire, wound into the form of a spiral, or by terminating them with cylinders of charcoal and then bringing these into contact. In each case the light is produced by the ignition of the conducting medium. Platinum or iridium is not so well suited for the purpose as charcoal, because, in the first place, the light is never so vivid, and, in the second place, the metal is very likely to fuse, and put a stop to the experiment. When charcoal is employed, it is found that the greatest intensity of light is produced by drawing the points apart from a quarter to half an inch, and then there is a stream of finely-powdered charcoal in a most intensely ignited state, forming an arc of flame. If the charcoal points are too close together we do not obtain the maximum effect, and if they are too far apart the arc is broken and the light extinguished. This it is which constitutes the difficulty in keeping up the electric light, and which gives the flame its unsteady and flickering character.

There have been several electric lamps invented, but the most perfect are those of MM. Duboscq and Serrin, of Paris.

Mr. Holmes has, within the last few years, made a considerable improvement in obtaining electricity, by constructing a large magnetic machine, which is driven by steam power, a description of which he gave in this room a few years ago.

The last magneto-electric light is that of Mr. Wylde. It is sufficiently brilliant for photography, but the apparatus is so ponderous that it requires steam power to work it.

Before quitting this subject I must not forget to mention the light caused by the ignition of the metal magnesium; but the great difficulty in getting this light to burn steadily, and also the expense of the metal, tend greatly to preclude its introduction into general use.

The last invention with regard to artificial illumination is the Augasma light, produced by causing atmospheric air to take up a large quantity of a very volatile hydro-carbon by means of a carburettor especially constructed for the purpose. This has been often attempted but without any practical success till now, owing to the defective arrangement of the apparatus. In Mr. E. Welch's machine the air is pumped by clock-work. As soon as the receiver is full, the lever is lifted, and stops the descending pump in its course by turning off a very well ground-in valve, thus arresting the movement of the clock-work. The air from these two pumps passes through into the receiver or governor, as it is sometimes called. The receiver is so weighted as to give the requisite pressure to the air for driving it through pipes. From the air-holder the air passes through the carburettor, where it takes up the hydro-carbon vapour. The construction of the carburettor is very complete and effective, and serves either for air or gas; but those for gas have much less surface than those for air. The hydro-carbon, though highly volatile and inflammable, is not explosive. This hydro-carbon can be extracted from most of the commercial, hydro-carbon oils, such as petroleum, &c., but its manufacture is only known to the inventor and a few others.

In conclusion, I desire to call your attention to a most important subject, namely, that of street illumination; and I think that you will agree that there is great room for improvement in this branch of artificial illumination.

The present mode of lighting the public thoroughfares is very inefficient, inasmuch as the lamps now in use merely act in the distance as beacons, to show the line of demarcation between the road and the pavement, and when one is close to them they are comparatively useless, as nearly all the light is thrown upwards, and upon the walls of the houses, the place where it is not required; indeed, I have found it almost impossible to read a letter under the brightest lamp. The place where the light is wanted is in the road and on the pavement; and to remedy the present defect, I should advise the burners being placed horizontally, instead of perpendicularly, as they are now; the result of this slight and inexpensive alteration would be that the pavement and road would be well lighted, and none of the rays would be lost. I have, after several experiments, contrived a burner which is now alight in a lamp, also of my own design; it is very simple, not liable to get out of order, and shadowless. The upper portion, forming a concave reflector, is proposed to be made of enamelled iron, it being very durable, easily cleaned, and capable, in case of accident, of being replaced at small cost. The bottom is a semicircular glass globe, which, like the top, would cost but little to replace in case of breakage. The whole is connected to the pillar by a clamp and vulcanized india-rubber washer, and is so firmly fixed that the strongest gale of wind cannot affect it. The top reflector is fastened on to the globe by means of screws or clamps. The burner is in the form of two bird's wings, one of which is to give light on the pavement, and the other on the road. These burners can be constructed to pass the

usual amount of gas allowed for street lamps, viz., from four to five feet per hour. I wish it to be particularly understood that I have not spoken upon street illumination for the purpose of introducing this lamp and burner, but I have thought that it was time that such an important subject should be prominently brought before the public.

DISCUSSION.

Mr. KING wished to ask Mr. Defries whether, in having two flames, as in the case of the burner he proposed, instead of one, for the street lamps, there was not a loss in the illuminating power? It was a well-known fact in gas lighting, that a single burner, consuming 5 feet of gas per hour, when divided into two burners, each consuming 2½ feet per hour, involved a loss of 25 per cent. of illuminating power. That would be found to be the case with the street burner now exhibited. He granted that the horizontal projection of the flame utilised the light; still, by the division of the flame in the manner shown, there must be a great loss of illuminating power. Having had considerable experience in the carburetting of gas, he might say, with reference to the apparatus before them for that purpose, and the remark of Mr. Defries that the oil was non-explosive, that he had mixed it with air in certain proportions, and exploded it with an electric spark.

Mr. CHAFFINS inquired whether the elegant-looking gas standard exhibited was much more costly than those now in use?

After a few words from Mr. ASHE,

Mr. ELT, on the subject of the present imperfect street lighting in the metropolis, said he thought the blame did not rest with the vestries and district boards, as had sometimes been asserted, as we were entirely in the hands of the gas companies in that matter. The local authorities made the contracts with the gas companies, but the servants of the companies lighted the lamps, and the vestries had no control whatever over the lamp-lighters. He did not wish to utter a word of suspicion as to the gas companies desiring to defraud the public in respect of the street lamps, but their servants were sometimes careless; and it was within the knowledge of all present that half the street lamps were not turned on so full as they ought to be. They were probably aware that great reforms in the matter of gas lighting in London were contemplated by the Government and the Board of Works, and he hoped one provision of the new measure would be to give the local boards more control over the public lighting than they had at present. For his own part, he thought it would be much better if the street lamps were so arranged that the tap, when turned on fully with a stop, should give the amount of light which was bargained for on the part of the public, and that the lamps should be lighted by persons under their control instead of by the servants of the gas companies. He was very much struck with the appearance of the standard for street lamps shown by Mr. Defries, but, as far as he could judge, it did not appear to yield so much light as the present single burner in the street lamps when properly turned on. That might be owing to the division of the burner into two. It must be admitted on all hands that there was considerable room for improvement in the existing lamp standards in London, both as regarded the pattern of the pillar and of the lantern. He was glad to find that in the City some improvement in this respect had already taken place, and he hoped the vestries and district boards of the metropolis generally would follow that example, and that, gradually, there would be introduced into the main thoroughfares standards a little more pleasing to the eye than the unsightly things now erected.

Mr. WEBBER thought the present mode of distributing gas through large iron mains was both clumsy and expensive. He thought some lighter and less costl material would answer the purpose.

Mr. DEFRIES, in reply to the questions put to him, said, in the first place, with respect to the hydro-carbon used in the apparatus of Mr. Welch, his information with regard to its non-explosive nature was derived from Mr. Welch himself, and was confirmed by his own experiments. The secret of the manufacture of this hydro-carbon remained with those who had introduced it; all he could say was that it was perfectly unexplosive. In the next place, with regard to the alleged loss of 25 per cent. in illuminating power from dividing the burner into two jets, he would say that two lights even of less illuminating power when placed judiciously were better than one light of greater illuminating power placed injudiciously. With respect to the use of a lighter material than iron pipe for the main distribution of gas, the traffic was so great that any light material would be soon destroyed.

Mr. GEORGE WHITE suggested that the lantern in the gas standard exhibited would, he thought, be improved by the upper metal portion being made a reflecting surface, and placed a little higher above the light. He quite agreed with the objections that had been made to the present form of the lantern in street lamps, which gave light above rather than below, and the shades of the bars cast beneath were perplexing to people of imperfect sight who might be crossing the road. He thought, with little additional cost, they might have a form of lantern which could cast the light where it was wanted, and obviate the gloom caused by these shadows. He would also say a word on behalf of the local authorities in respect of public lighting. To his own knowledge many of the vestries were very anxious to get a better-looking lamp-pillar than the one now in use, and he was pleased to see that the Society had had one brought there for inspection. He would like to see a competition of twenty or thirty designs of lamp posts, from which a good one might be selected. A great difference was observable between the public lights and those in the shop windows, which was no doubt in consequence of the more intelligent mode adopted by the shopkeepers in consuming the gas. He was further struck with the fact that in those streets which were the best lighted from the shop windows, the public lamps were always lighted a considerable time before those in the more private streets. He thought the reverse of that ought to be the case, and that in many of the main thoroughfares, consisting entirely of shops, many of them lighted by twenty or more burners, the public lamps did not require to be lighted till the evening was somewhat advanced, and when the shops began to be closed. He would say a word or two with regard to the position of the gas companies, and as to whether the Government should take up the question of the gas supply in the metropolis. He thought that public companies were often blamed when they did not deserve it. The introduction of gas lighting, as they well knew, was brought about by the enterprise of individuals who formed themselves into public companies, and, by the traffic in shares and the profits derived from the gas manufacture, made large sums; but they gradually became close corporations, doing very much as they liked as to the prices they charged for their gas. It was well known that gas was produced at the works at a cost of 1s. 8d. per thousand feet, and the expense of distribution was 1s. more—the remainder between that and the price charged to the consumer being profit to the company. It was true they were restricted to 10 per cent. profit, but they were not restricted as to the most economical modes of manufacture and distribution; and the limitation of the dividends under the monopoly in gas which now existed in London, did not tend to such a reduction in the cost to the consumer as they had a right to expect. Why should not gas lighting be thrown open to competition, and conducted on free-trade principles like any other

business? If that were done the public would take care to supply themselves with the best quality of gas they could obtain. Some people were in favour of putting this matter into the hands of the Government. He thought that would be only "getting out of the fryingpan into the fire," because private companies were amenable to public opinion, which would not be the case with the Government.

In reply to questions put by Mr. BLACKIE and other gentlemen,

Mr. DEFRIES stated that the consumption of the two jets burning in the lamp before them was only $3\frac{8}{10}$ feet per hour, the standard of consumption in the present street lamps being five feet per hour, the lantern in the latter case being placed some three feet higher than was required for street lighting. The cost of the glazed portion of the lantern was not more than two shillings and sixpence. The first cost was less than that of the present lamp-posts.

Mr. KING said, three or four years ago he drew the attention of Dr. Letheby to a lantern somewhat similar to that now before them, having a metal top and semi-spherical glass bottom, with a view to its introduction in the City; but an objection was taken to it on account of the gloomy effect produced above by the opaque metal top. It was well-known that coal gas depended for its illuminating power upon the quantity of carbon it contained; but they might overburn that carbon; and, to get the full amount of illuminating power out of the carbon which was in the gas, they must supply it with only the necessary amount of air and no more. If too much air was supplied the carbon was overburnt, and there was a corresponding loss of illuminating power. This was obviated to a great extent by the argand burner. With regard to the lamp before them, he believed it did not at that time give the light of more than five or six candles, whereas a public lamp was expected to give the light of twelve or thirteen candles. It was a question with him whether the horizontal position was the best one for the flame. If the gas were carburetted, and the flame placed in a horizontal position, it would almost fill the lantern with smoke. Care must always be taken to use a kind of burner which was suitable for the description of gas burnt. Gas rich in carbon required to be burnt through fine apertures; if large apertures were used imperfect combustion resulted.

The CHAIRMAN said, before proposing a vote of thanks to Mr. Defries for his interesting paper, which had elicited a no less interesting discussion, he would offer a few remarks on the subject. Mr. Defries had very ably treated the practical portion of the subject of gas illumination, but in the discussion reference had been made to what he (the chairman) considered a more important branch of the subject, namely, the question as to the propriety of the supply of gas being continued in the hands of the companies, or whether it should be taken from them and undertaken either by the City authorities or the Government as a means of improving the supply in respect of regularity and economy. Many persons present would recollect a few years ago there was a great effort made to obtain what was called a consumer's gas company in the City of London, which took the name of what it was intended to be in reality—"The Great Central Gas Consumers Company." The result of that attempt, in which all kinds of influences were used to show how inferior was the gas supplied by the old companies, and how important it was that the consumers in the City should have better gas at a lower price—the result had been to show that the company formed under such circumstances had gradually become as great sinners as the others, and were as anxious to maintain the price of gas as they had ever been. There was nothing more than a repetition of what had happened before. Complaints were made, not always based upon reason, and frequently not on fact, and in the end the public had to pay for the formation of this new company, and the interest of the capital expended in addition to what they paid before, without realizing the expected improvement in the quality, or economy in the price, of the gas. He did not think placing the monopoly in the hands of the Government or the Board of Works would give them gas so cheap or a supply so constant as when it was in the hands of half-a-dozen or more companies, who were anxious, by the good quality of the article they supplied, to secure customers on the one hand, and a good dividend for their shareholders on the other. As to free trade in gas, he thought they had it sufficiently already, as was shown by the inconveniences occasioned by the constant breaking up of the streets for the laying down of pipes. If the public were not satisfied with the gas of one company, they could, in many cases, take that of another. He was quite aware that the system of distributing the metropolis among the several companies had been carried on to a great extent, but there were still some localities where a supply could be had from more than one company. There was competition in the city, where the consumer had the opportunity of comparing the quality of the gas of one company with that of another. With regard to the lighting of houses and shops, the illustrations of the different forms of burner given by Mr. Defries that evening were highly interesting. The question of carburetting the gas was no doubt a difficult one on which to give a decided opinion. It had been adopted in many places, no doubt with great advantage, but he doubted whether it would be successful on a large scale. They had in the room in which they met the great advantage of that admirable system of lighting known as the sunlight, which not only afforded the best possible light, but at the same time aided in producing good ventilation. The magnesium, the oxy-hydrogen, and the electric light were useful under particular circumstances, and were interesting as matters of scientific experiment, but scarcely entered into the question of internal illumination. He thought they might look forward to great improvements in this matter if, as he believed was contemplated, the gas works were carried further out of London, and the sites of the present works appropriated to more profitable purposes. He looked forward to London being supplied with a better quality of gas, at a cheaper rate, under the influence of purely commercial competition, rather than as the result of any government interference. By the concentration of the gas works, a corresponding economy in the manufacture would result, and the public would receive greater advantages than would ensue from taking the business out of the hands of the companies and placing it in the hands of the Government, or in those of any centralised municipality. He had now only to ask the meeting to record their thanks to Mr. Defries for his able and interesting paper.

The vote of thanks was then passed.

Mr. Defries illustrated his paper by showing the various forms of artificial illumination, including the electric, magnesium and oxy-hydrogen lights, the Augasma light, and the various forms of gas burners, with the modes adopted for carburetting gas.

THE "COURSE" SYSTEM FOR LONDON CABS.

BY JOHN L. HADDAN, ESQ., C.E., HACKNEY CARRIAGE DEPARTMENT, METROPOLITAN POLICE.

In the *Journal of the Society of Arts* for last week, Sir Richard Mayne, K.C.B., is reported to have stated that—"He considered the system of fares by the 'course' the one best calculated to avoid disputes; but he believed that to be inapplicable in a place of the vast extent of London, though at the same time payment by distance must necessarily lead to disputes, and, in the case of strangers, to overcharge." Acting on these words,

emanating from such an authority as Sir Richard Mayne, whose opinion, owing to so many years' experience, must be most valuable, the following plan has been devised, which it is believed fully secures the requirements and meets the objections which he has so justly pointed out as vital ones.

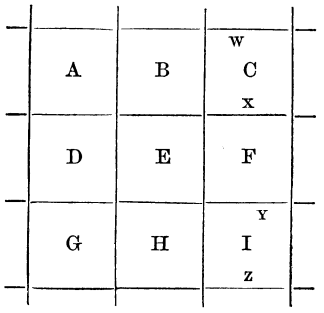
It is quite obvious that any system of fares to be convenient must also be approximate, for it would be an endless source of dispute, besides requiring very accurate means of calculating distances if a fare were computed according to the exact distance travelled, for instance, $1\frac{1}{4}$ miles, at the rate of 6d. per mile, would be $7\frac{1}{2}$d., a very inconvenient sum to pay, requiring small change.

The present system is also only approximate, a hirer paying the same fare for 1 mile 5 yards as he would for 2 miles, viz., 1 shilling.

The "course" unmodified would not be applicable to a large city like London. The same fare say, from Brixton to Mile-end, as from Langham-place to one of the clubs, would clearly not be sufficiently approximate.

There is no reason, however, why London should not be divided into a certain number of squares, or irregular figures, of about $1\frac{1}{2}$ miles area each; of which, within the four-mile radius, there would be 26, each square being distinguished by a letter of the alphabet.

The fare may be quite arbitrary, each square being considered a course; two squares, two courses; and so on; but, for the sake of illustration, I have adopted 6d. for each course or square, and only inserted 9 squares (instead of 26) in the tables:—



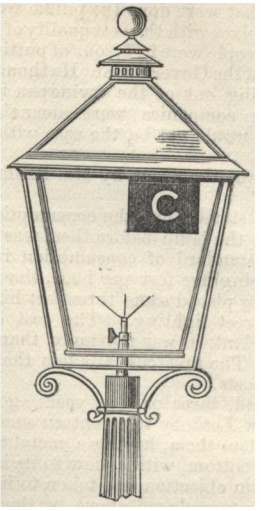
These fares are likewise only approximate, as in the one case the cabman might be hired, say, at Y and discharged at X, receiving 1s. 6d. for $1\frac{1}{2}$ mile distance (having passed into three courses), but from Z to W would be $4\frac{1}{2}$ miles, for which he would likewise only receive 1s. 6d.; this sum being found to be the exact mean fare for the two extreme distances, viz.:—

$1\frac{1}{2}$ miles at 6d.	=	0s.	9d. minimum
$4\frac{1}{2}$ „ at 6d.	=	2s.	3d. maximum.
2) 6	=	2) 3s.	0d.
3	=	1s.	6d. average.

This, though quite just, seems, at 6d. per mile, rather hard on the driver; but it will be readily seen that by enlarging or diminishing the dimensions of the squares, or by altering their value, an exact scale can be arrived at.

Taking long and short fares together, the cabman would be the gainer, as for one person who went from extremity to extremity of a division there would be hundreds who took a medium course.

The table being compiled with the assistance of a map properly divided, the map, so far as the public is concerned, is dispensed with; the method of enabling the public to ascertain the limits of the various divisions must be more simple; and the method I propose is to have the initial letter of the district made of coloured glass, or cut out of tin, and affixed either to every lamp-post in the metropolis or in the fanlight of every house—in the latter case the number of the house being also added, thus:



FROM A	B	C	D	E	F	G	H	I	TO
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	
0 6	1 0	1 6	1 0	1 0	1 6	1 6	1 6	1 6	A
1 0	0 6	1 0	1 0	1 0	1 0	1 6	1 6	1 6	B
1 6	1 0	0 6	1 6	1 0	1 0	1 6	1 6	1 6	C
1 0	1 0	1 6	0 6	1 0	1 6	1 0	1 0	1 6	D
1 0	1 0	1 0	1 0	0 6	1 0	1 0	1 0	1 0	E
1 6	1 0	1 0	1 6	1 0	0 6	1 6	1 0	1 0	F
1 6	1 6	1 6	1 0	1 0	1 6	0 6	1 0	1 6	G
1 6	1 6	1 6	1 0	1 0	1 0	1 0	0 6	1 0	H
1 6	1 6	1 6	1 6	1 0	1 0	1 6	1 0	0 6	I

EXPLANATORY.—On hiring a cab look at nearest lamp (say H); on discharging cab look at nearest lamp (say A). Refer to table—H to A = 1s. 6d. A foreigner can as easily do this as a native, no knowledge of site being requisite.

This plan quite prevents all chance of the driver going a roundabout way, his interest being to go as directly as possible; it also contains a very important feature, viz., that it states the exact legal fare from any one point to any other, and not, as at present, where, after going into tedious calculations and judging distances, the hirer arrives at what he imagines to be the right fare, but which he is by no means sure is the legal one; this, of course, renders disputes almost unavoidable—the cabman's idea of a mile being, naturally enough, the very opposite to that of the hirer. A foreigner or stranger must, of necessity, go to the wall under these circumstances. An index on a cab would never be in working order a week, it being the driver's interest to derange it as quickly as possible.

This system has the great advantage of being final, and not, as at present, subject to revision whenever changes of streets, &c., take place in the metropolis.

The plan and tables have all been worked out, the table only occupying a space of 9in. × 7in., in large type, is not too large to be affixed to the inside of every cab door.

All objections as to stoppages, rehiring, &c., during a course are met by the present system of hiring by time.

The cost of introduction would be but trifling, and the system might be in working order in a month.

Fine Arts.

NEW COURTS OF JUSTICE.—The designs of the eleven competing architects are now on view in New-square, Lincoln's-inn. The chief purpose of the proposed new buildings is to concentrate the several courts of justice and the offices connected therewith, and the object of this concentration is to afford greater facility for the dispatch and accurate transaction of the law business of the country. The plot of ground on which the new law courts are to be erected may be described generally as lying between Temple Bar, St. Clement's Church, Lincoln's-inn, and Chancery-lane. The courts here to be concentrated are the Equity, the Common Law, the Probate and Divorce, the Admiralty, the Ecclesiastical, the Appellate Court, and the Bankruptcy Court. To these may be added "The Land Registry Office," "The Registry Office of Judgments, &c., affecting Land," "The Middlesex Registry Office," &c. Thus is made a total of no less than sixty-four courts, chambers, and offices. The printed instructions state that upon convenience of arrangement will mainly depend the success or failure of the concentration, and accordingly the architects have devoted no small pains to the ground plans and the distribution of the basement and floors above. Care has also been taken to obtain abundant light, to secure the quiet needful for the transaction of business, and the air essential to ventilation. The competitors have also been required to consider all points relating to acoustics, heating, water supplies, and prevention of fire. The detailed plans prove that much attention has been devoted to such arrangements, also to the no less important matters of ready ingress and egress, to the separation of the sight-seeing public from the profession, to refreshment courts, conference chambers, and generally to the convenience of witnesses, attornies, counsel, and judges. The plans also provide a substitute for Temple Bar, loftier than the present structure, in order to facilitate the traffic of the Strand; likewise a bridge on the north side, over Carey-street. These two bridges are covered ways, and will serve as means of communication with the Temple and Lincoln's-inn. In addition to these bridges, it is proposed that a tunnel or subway shall be constructed under the Strand, between the Temple and the new courts, on the site of Temple Bar; and another, large enough for foot passengers and trucks, under Chancery-lane into the Rolls estate. The architects have also been required to consider the means by which the increase of street traffic may be accommodated, especially on the side of the Strand. Each series of designs includes plans, drawn to a scale of one inch to 16 feet, of each floor, sections showing internal construction, elevations of each of the four sides or fronts, and a perspective or bird's-eye view. The architect also gives in words a general description of his design, of the materials to be employed, and of the mode of carrying the plan into execution. In few words may be designated the general architectural features of the eleven several designs. Without a single exception Gothic is the style adopted. Three of the competitors, viz., Mr. Street, Mr. Burges, and Mr. Seddon, have chosen somewhat castellated, domestic, or secular forms. One, Mr. Brandon, obviously leans to ecclesiastical skylines and details, as marked in a couple of spires, and a central hall not unlike La Sainte Chapelle outside, and the nave of Westminster Abbey inside. Mr. Lockwood's Strand façade is crowned by a lofty tower, which recalls the campaniles of Belgium and Italy. His use of coloured stones and certain other details have points of analogy in Giotto's Tower and the Cathedral of Sienna. It may be said, generally, that the designs, as a whole, indicate foreign—especially Italian—influence. A striking feature in Mr. Lockwood's plan is the central hall, which may vie with that of Westminster. It should also be observed that in the construction throughout there are no top or borrowed lights. Mr. Garling's towers are less prominent than most of his competitors, and he dispenses also with the central hall, which in other plans is wrought into a leading architectural feature. He is of opinion that a corridor better consults convenience. It may be remarked that Mr. Garling's is the lowest estimate. Mr. Deane, also, for convenience, breaks up his ground plan into distinct blocks. In this way he deems that light, ventilation, and ready access are more easily obtained. Mr. Waterhouse has followed, with modifications, the style of his own law courts in Manchester, which are quoted as precedents both by lawyers and architects. It is shown that his towers will form a striking group in the general view of the metropolis. The three remaining designs, viz., those of Mr. Abraham, Mr. Barry, and Mr. Scott, have this in common, that they surmount the central hall by a dome. In this country a dome is a new feature in Gothic architecture. In association with the pointed arch it is of Eastern origin; and Mr. Scott adopts the ogee curve, which the Saracens used at Cairo and elsewhere. It may be added that the highest of the ten estimates is above two millions, and the lowest slightly above one million sterling. Each competitor, except the successful one, receives £800. The architect whose plans are adopted will be paid 5 per cent. on the outlay.

Colonies.

LANGUAGES OF THE AUSTRALIAN ABORIGINES.—A Sydney paper says:—The Rev. L. E. Threlkeld wrote a work on the languages spoken by the Australian blacks, for the Great Exhibition of 1851; but little has been done since towards bringing them under those rules which govern that of more enlightened peoples. The Rev. W. Ridley, M.A., has, however, followed the example of Mr. Threlkeld, and compiled a grammar of the languages spoken by the aborigines of Australia, for transmission to the Paris Exhibition. This addition to philological research will be of interest to many in Europe, as the aboriginal languages are by no means insignificant in point of euphony or expressiveness. The author states that, limited as was his acquaintance with the several languages referred to, "he has met with abundant evidence of the remarkable regularity, and of the exactness with which the aborigines express various shades of thought. The inflections of verbs and nouns, the derivation and composition of words, the arrangement of sentences, and the methods of imparting emphasis, indicate an accuracy of thought, and a force of expression, surpassing all that is commonly supposed to be attainable by a savage race." The various languages treated of are—Kimilaroi, spoken by those who inhabit the country on the Namoi, Barwan, Bundarra, and Balonne Rivers, Liverpool Plains, and the Upper Hunter; Dippil, by the aborigines of the north side of Moreton Bay, and thence to Wide Bay, and the Burnett district; and Turrabul, the language spoken by the aborigines on the Brisbane River. There are also references to the laws of descent and marriage, and a comparison of the various languages. The work is illustrated with drawings.

Publications Issued.

THE WATER QUESTION. By J. Bailey Denton, Principal Engineer to the General Land Drainage and Improvement Company. (*Edward Stanford.*)—This pamphlet consists of a letter, addressed (by permission) to the Earl of Derby, explaining a proposal for the supply of the metropolis from the higher sources of the Thames in conjunction with the storage of surplus

waters. The author begins by referring to the Rivers Commission, appointed the 18th May, 1865, "for the purpose of inquiring how far the present use of rivers or running waters in England, for carrying off the sewage of towns and populous places and the refuse arising from industrial processes and manufactures, can be prevented without risk to the public health or serious injury to such processes and manufactures, and how far such sewage and refuse can be utilized or got rid of otherwise than by discharge into rivers, or rendered harmless before reaching them;" and, next, to the proceedings of the Committee of the House of Commons of last Session on the Thames Navigation Bill, which resulted in a compact between the several water companies of the metropolis and the late Government, who were promoting the Bill, by which all towns on the banks of the river are to be prevented from discharging their sewage into it, and the water companies are, with that understanding, to continue to draw their supplies from the river on an annual payment of £1,000 each; both the proceedings of the Commission and the arrangement of the Committee being based on the assumption that it is practically possible to "prevent the pollution" of rivers. This the author regards as a fallacy, and he maintains that the only way by which the rivers can be maintained in their aboriginal purity, and in a condition fit to drink, is to exclude from them, wholly and completely, contaminating fluids; but, inasmuch as all fluids flow to the lowest place, and rivers occupy the lowest place in all water sheds, with the sea as their ultimate destination, it is obviously impossible to "prevent the use of rivers" for carrying off, in some shape or other, the refuse liquid of the towns and lands within their water sheds. The Rivers Commission, seeing this insurmountable difficulty, adopted the views of a previous Commission "for inquiring into the best mode of distributing the sewage of towns," and recommended that irrigation should be employed, as the best mode of lessening the obnoxious character of refuse fluids before they arrive at their natural destination. They state in their report, that "all expedients for disposal of town sewage other than by application to land, seem to us, on one ground or another, objectionable." They declare that "sewage water, if passed over a sufficient area of grass land, passes off bright, tasteless, and without smell;" and add, "that irrigation will be found to be the mode of dealing with sewage which results in the largest amount of good to the land, and the smallest amount of harm to flowing water." With regard to irrigation as a means of purifying rivers, the author quotes the opinions of some of the leading chemical and medical authorities, including Sir Benjamin Brodie, professor of chemistry in the University of Oxford, Dr. Voelcker, Dr. Odling, and Dr. Fuller, who all appear to agree in the conclusion that no process can render sewage available for drinking purposes. Mr. Denton shows that the natural *régime* of rivers admits of the supply of pure and the discharge of polluted water at the same time, and urges that "instead of straining after such irreconcileable objects as using river water to dilute sewage in order that we may drink it, we should draw the line between the upper portions of our streams which can be maintained in purity and the lower portions of the same, into which the refuse of towns and populous places must in some shape or other enter to be discharged to the sea." He goes on to say—"Perhaps of all rivers the Thames, in its upper tributaries, commands the purest and clearest of water; and for some length downwards from the rise of the springs, the streams are remarkably free from organic matter. If, therefore, it is a *sine quâ non*—as every one now admits it to be—that we should have in the metropolis a sufficient supply of perfectly pure water, we have, in the higher portions of the tributaries of the Thames, and in the supplies to be obtained by pumping and from storage, ample means of meeting all possible demands without going beyond the limits of the Thames water-shed. To abstract water from the tributaries without injury to the navigation and mills, and the general service of the river below, proper measures for compensation must be adopted, so as to return to the streams as much water as may be abstracted from them under a certain fixed datum of service height. The present consumption of London may be taken at one hundred millions of gallons per diem: about one-half is supplied from the Lea and from chalk springs on the eastern side, and the remainder from the upper Thames on the western. According to authorised published statements, the New River and East London Waterworks Companies have supplied, from the river Lea and from wells sunk into the chalk, nearly forty millions of gallons daily during the last dry summer; and under a strict conservancy of the Lea, they may continue to supply that quantity in a pure state instead of that in which it is at present. This quantity may, in fact, be regarded as a minimum, if storage, for compensation simply, be resorted to, and all sewage excluded from the river above the points of abstraction. By extending the system of storage to the collection of surplus water for direct service, the supply may be increased to a very much larger amount. Under a like exercise of conservancy and storage, there is no doubt that the other tributaries of the lower Thames may be made to contribute their quota. They consist of the Yedding, Brent, Roding, Hog's Mill Stream, Wandle, Ravensbourne, and Darent. The Kent Waterworks Company have shown that more than five millions of gallons daily may be and are obtained from artesian wells sunk into the chalk, and the Essex Pure Water Company are advertising several millions of gallons daily from the chalk springs at Grays. These figures show that we possess in the rivers and springs flowing from the chalk a valuable property within our own watershed which is by no means exhausted by the fifty millions of gallons supplied daily by the New River, East London, Kent, and Essex Pure Water Companies. The storage capabilities of the chalk streams are great when compared with the actual requirements of the population they would serve. For example, while the minimum daily flow of the Lea, at Field's Weir, during the driest month in the dry year (1851), in which the rainfall was 22·62, was about forty millions of gallons, the maximum, in the same month (October), was upwards of seventy-two millions; and the several streams rising in the chalk are all affected in like manner. But I will confine my observations to the tributaries of the upper Thames on the western side of London, rising for the most part in the oolite. The quantity at present supplied to the metropolis from the Thames, at Hampton, does not reach sixty millions of gallons daily. This will gradually increase, and it will not be many years before we shall require eighty millions of gallons, or more. To arrive, however, at the quantity of water for which provision must be made from the upper tributaries, we must have equal regard to the towns and villages dependent upon them as to the metropolis itself, and the whole supply should be viewed as one measure. The population of these towns and villages, was, by the last census, 179,884, and to supply this number of people with thirty gallons each will require 5,396,520 daily. This consideration will increase the present quantity to sixty-five, and the total future provision to, say ninety millions, to be obtained from the upper Thames. The area of land surface tributary to the Thames above Hampton is 2,352,640 acres; the average annual rainfall is slightly under 26 inches and the minimum 20 inches. As the total quantity of water required in the year for the population dependent on the upper Thames and its tributaries in 23,725 millions of gallons (*i. e.*, sixty-five gallons multiplied by 365 days), it follows that less than half an inch of rainfall over the whole area, or less than one-fortieth part of the minimum rainfall, will suffice to meet the present requirement." After describing some of the means by which the water at command may be economised, and a

considerable portion rendered available for storage, the author proceeds to speak of storage for compensation and supply. He says:—"The Thames and its tributaries are especially rivers of floods, and a single inch of rain falling in a day has been known to nearly double its volume when at its standard height. The proportion of the rainfall discharged annually to the sea by floods cannot be stated, but the minimum can hardly be less than three inches, or the quantity that has been represented as the perennial supply of the Upper Thames. This surplus alone will therefore amount to seven times the quantity required for metropolitan supply. It is difficult to state to what extent the storage of surplus waters may not be beneficially applied. It may be resorted to as a means of compensating the streams for pure water taken from them, as well as for direct supply. The extent of storage room that would be necessary would be 1,000 acres, of a mean depth of 20 feet, for the collection of water for direct supply; and 2,000 acres of a mean depth of 10 feet, for compensation." The following is a brief description of the works proposed by Mr. Denton:—"The head of the proposed works would be the fork formed by the Thames and Severn Canal (extending from its summit at Thames Head to its junction with the Thames at Lechlade) and the North Wilts Canal. It will be remembered that, during the last Session of Parliament, the Thames and Severn Canal Company sought powers to convert their canal into a railway. It was then stated and admitted that the canal was not in a profitable condition. It would be necessary to purchase these canals, and, by rebottoming, convert them into impervious conduits for the collection of pure water from the upper portions of the Churn, the Swill Brook, and the River Ray, and of such additional water as may be obtained by the restoration of the three millions of gallons which now runs into the Severn, as well as by additional pumping at spots, distant from each other, along the line of oolitic outcrop, whereby a considerably increased amount may be gained, which would otherwise be lost. Reservoirs would be made along the course of the three streams named, to afford compensation for the water abstracted from them. From Lechlade to the meadows just below Oxford (where it would be desirable to have a supply reservoir) a channel would be formed following the course of the Thames—paved with concrete, and embanked so as to allow of the utmost cleanliness and prevent the influx of surface drainage and flood water—which would act as a receiving conduit for the pure water to be furnished by the several tributaries which it will cross and meet on its way. The tributaries that would be crossed and met would be the Ampney Brook, the river Colne, the river Cole, the river Leach, the river Windrush, the river Evenlode, with the river Glynne, and the several minor streams which join the Thames above Oxford. At Oxford the receiving main would join the supply to be gained from the Cherwell and branches above the point of pollution, as well as by storage in reservoirs formed in the higher lateral valleys for direct supply. From the supply reservoir at Oxford another paved conduit would convey the water by Abingdon to a point near Wallingford, having received contributions of supply from the Ock and the Thame. From thence to Hampton the water thus collected would be delivered to the water companies' works by a covered channel, having received in its course the contributions of the Kennet River, the Lodden, the Colne, and certain springs rising near the main river, making up in the whole a supply of 80,000,000 of gallons daily. Oxford, Abingdon, Wallingford, Reading, Windsor, and the towns and villages on the banks of the rivers would have been previously supplied from the conduit as it passes by them to the amount of upwards of 5,000,000 of gallons daily. The open conduit, from its commencement at Lechlade to Wallingford, would be of a semicircular form. It would increase in dimensions as the tributaries added their quota to the volume. The covered duct would be 8 feet deep by 10 feet wide. The mean fall would be nearly 20 inches per mile. From Lechlade to the meadows near Oxford the distance is 29 miles, and the fall 48 ft. 6 in. From this point to a point above Wallingford, the distance 23 miles, and the fall 40 ft. 6 in. From thence to Hampton, the distance is 75, and the fall, 121 ft. 6 in.—Total length, 127 miles; fall, 210 ft. 6 in. These works on the upper Thames would be extended to the necessary conduits connecting the unpolluted portions of the tributaries with the receiving main, and would include the construction of reservoirs, the purchase of the special mills affected, and compensation to landowners, &c. On the Lea, of the lower Thames, a similar, though reduced system of works would be carried out. The cost of the whole may be estimated at £4,500,000, including interest on money expended and attendant expenses." In conclusion the author points out the objections to abstracting the waters of one district for the purpose of supplying another.

Notes.

THE METRIC SYSTEM.—The Metric Committee of the British Association and the Council of the International Decimal Association announce that a conference with deputies of Chambers of Commerce and consular authorities in this country, for the purpose of promoting the practical use of metric weights and measures, and the introduction of an international decimal system of coinage, will be held on Tuesday evening, the 19th instant, at seven o'clock, in the Great Room of the Society of Arts, by permission of the Council. The questions more particularly to be considered are:—1. The legal position of the metric system in this country under the Permissive Act, without the corresponding power for stamping weights and measures of the metric system, and the legalisation of authorised standards of the same. 2. The introduction of metric weights and measures into the public departments, especially in the Post-office and the Customs; the official preparation of the tariff in metric equivalents, with authority to pay duty according to the same; and the preparation of statistics by the Board of Trade to represent the comparative value. 3. Means, which may be adopted by Chambers of Commerce for promoting the voluntary use of the metric system among merchants and manufacturers, such as the preparation of special tables for the various trades, for converting prices and quantities from the metric into the imperial system, and *vice versâ;* and the exhibition of a mural standard of the metre in public places in the principal ports and market towns. 4. Steps to be taken for securing representatives of the Chambers of Commerce at the conferences to be held in Paris in connection with the special exhibition of weights, measures, and coins, during the universal exhibition. 5. The conditions of the International Monetary Convention lately entered into between France, Italy, Belgium, and Switzerland, in so far as it may be applicable to this country. The conference is open to members of the Society of Arts.

Correspondence.

THE CAB QUESTION.—SIR,—I regret that I was unable to attend the important discussion opened by Mr. Cole last week, on the subject of the cab conveyances in the metropolis, or I should have submitted that the evils in question are remediable by the application of a large administrative principle, which I have elsewhere expounded in its application to several branches of administration, and have termed "competition *for* the field," as opposed to the common practice of "competition *within* the field" of service, which some eminent economists concur with me in repudiating. I consider

that all public means of vehicular communication by carriages plying in the public highways must be subjected to regulations and responsibilities on behalf of the public, and that the means of doing so, and preventing the evils in question, will be to charge some one administrative authority (and, in the absence of others, the duty might well be charged on the head of the police), with putting up the entire field of service to competition by tenders in answer to the invitation, as in the instance of the postal mail or packet service:—"Will you (individual capitalist, or company) undertake to provide the required and specific service for the public (the whole field), with what sort of cabs or other vehicles, and at what rates of fares, for a given period?" I here venture to quote a few passages from a paper expository of the principle as applied to several branches of administration, read by me before the Statistical Society:—

"The present condition of the cab service of London is one which appears to me to be so prominently illustrative of the evils of the competition of multiplied capitals within the field of supply, against which the opposite principle is the only effective preventive, that I beg leave to advert to them. The number of cabs now licensed in London is 4,500. Each common cab and the two horses, with the appointments requisite to work it, is estimated to cost not more than £60, so that the capital engaged is in round numbers upwards of £270,000, provided by upwards of 1,800 small owners.

"The waste of the capital committed by these competitions within the field of supply is visible to the eye at all times and all weathers—in full stands or long files, waiting hour after hour, and in the numbers crawling about the streets looking out for fares. The cost of the keep of each horse is estimated at 16s. 4d. per week; the depreciation of horse stock is put down at 2s. 6d. per week each, and of the vehicle at 8s. per week. The market value of the labour of such a man as the driver of a cab may be set down in London at 4s. per diem. The stable rent is at least 5s. per week per cab and horse, and with other minor items the capital invested for man, horse, and vehicle may be set down at about 1s. per hour lost during every hour during which the cabs are kept unemployed. On every cab stand where in foul weather, as well as fair, a dozen cabs are seen constantly unemployed, the administrative economist may see capital evaporating in worse than waste, at a rate of 12s. per hour, £7 4s. per diem—or at a rate of between two and three thousand pounds per annum, to be charged on some one—*i.e.*, the public. If all were employed, as the usual rate of driving is six miles per hour, they must be each employed at least four hours per diem to pay for their keep. If, however, the cabs were constantly employed daily, at least three horses must be employed, which would augment the charge by that of an additional horse at the rate of 4d. per hour. A large proportion of the cabs are employed during the whole 24 hours, but there are then two men, 'a night man' and 'a day man,' and three horses.

"It is probably a statement greatly below the fact, that at least one-third of the cabs are, the week through, unemployed; that is to say, one-third of the invested capital is wasted—a service for two capitals being competed for by three, to the inevitable destruction of one. As in other cases of competition within the field, efforts are made by violent manifestations of discontent at the legal fare, by mendacity and by various modes of extortion, to charge upon the public the expense of the wasted capital. Sometimes it is in the form of a piteous appeal, that the driver or the competitor has been out all day and has not before had 'one single blessed fare.' And yet the legal charge for the commonly wretched service of the man, horse, and vehicle is, when taken by the hour, nearly double, and by the mile nearly treble (when only two horses per diem are used) its actual prime cost, which, when driving, is at little more than six miles an hour, 2d. or 3d. per mile, and when waiting 1s. 4d. per hour. But there is now a cry from the cab proprietors that this charge of double the prime cost does not pay, as it probably does not under such a ruinous system. An appeal is proposed to Parliament for an augmentation of the fares; but such augmentations under this principle of competition within the field would only aggravate the evil, for it would lead to an increased number of competitors, and instead of there being a competition of three to do the work of two, there would be a competition of two or more to do the work of one—*i.e.*, a greater waste of capital to be paid for by some one.

"Since the reduction of the fares in 1852 the number of cabs in the metropolis, instead of being reduced, has been increased from 3,297 to 4,507 in 1857.

"If there were no legislative restraints, the extortion under the system of competition within the field would reach such a height as to go far to extinguish the service altogether, or confine it to cases of extreme necessity and very large means of payment. My friend Mr. Henry Ashworth, of Bolton, in an account of his travels in America, gives an illustration of this state of things. Speaking of New York, he says—'They have their coach-stands—coaches with two horses each, such as we formerly kept on hire, and the fares appear to be discretional, or according to bargain. Upon a rainy day the sum of two dollars, or 8s. 4d., was demanded as the fare for half-an-hour. I offered one-half the sum, and it was declined. I then pointed the attention of the driver to the string of 20 other carriages, all waiting to be employed, and remarked upon the uncertainty of his making any money at all within the next half-hour. He very coolly replied, "The rain is falling very fast, and I guess I'll spec it." He preferred to speculate upon the chances which might offer, and so I left him.'

"Examples of perfectly unrestricted competitions within the field are presented amongst the boatmen on the coast, when a belated traveller hurries from London, and presents himself to half a dozen or a dozen, say, of Deal boatmen, to be put on board a vessel just out of hail and on the point of starting. They see that unless the 'fare' is put on board he will lose his passage-money and his voyage, and instances have occurred where not one boat was to be hired for less than five pounds or more, to put him on board, or perform a service for which, at the rate of wages of men in regular employment of the class of the boatmen, as many shillings would be most liberal, not to say exorbitant remuneration. At Liverpool, where emigrant passengers are frequently belated, ships being delayed so long beyond their time that it is believed they will not start for days, when they suddenly do start, and a passenger on shore who has his wife and children on board, sees the ship turning past the rock, there the boatman's charges have arisen to such a height as to bring into competition steam-tugs, as being more economical as well as more certain.

"The execution of the laws for the regulation of the fares of watermen having been relaxed or fallen into desuetude, the charges of the watermen have so augmented beyond the legal rate as almost to extinguish the habitual use of boats on those parts of the River Thames little occupied by steam-boats or the larger craft, where conveyance by boats would be convenient or pleasurable,—if the charges were reasonable.

"At Richmond the boatmen require 2s. and 2s. 6d. per hour (sometimes, however, accepting 1s. 6d. for the second hour), which, at full work of ten or twelve hours, would give a remuneration of 15s. or 18s. per diem to labourers of a class to whom 5s. or 6s. would, for regular employment, be high wages. Double and treble the legal fares do not, however, satisfy the competitors, who charge their anxieties and discontents, as well as their losses, upon the public, for with all these extortions upon the public the condition of those engaged in such service is a wretched one. In the conflict of three men for the service of two, or of two for the service of one, anti-social feelings of the most malignant character are engendered, and in the necessity under which such people consider themselves to be placed of compensating themselves for the waste of their time and the risks of the competition, feelings are maintained of what I have characterised as a wolfish rapacity, to prey upon the necessities of all of the public who are exposed to them.

"In respect to this service of cabs—the analysed charges and statistics show that by a properly-conducted competition by adequate capital for the whole field—for which, in my view, the chief police or local administrative authorities ought, as servants of the public, to be made responsible—service equal to the present might be obtained at 4d. per mile; or at the present legal fare of 6d. per mile, a service approaching in condition to that of private carriages might be insured out of the mere waste which now occurs. Machines have been invented, which are stated to be convenient and not expensive, which, I am assured, measure time and distance, and determine for the passenger the fares to be paid, and register the earnings due to the proprietors. Under a system of competition for the field, such securities might be introduced. Isolated attempts to introduce such machinery into cabs have hitherto, even in Paris, been uniformly defeated by conspiracies of the whole body of the drivers. The machinery has been maliciously broken or spoiled by the drivers of other vehicles than those in which it was introduced. There are elements involved in the question, which may be referred to the moralist, who will agree that the waste commonly involves sin, malignity, demoralisation, as well as suffering. In this instance, the suffering is extended to the animals who minister to our convenience. The cab horses are driven mercilessly, and then returned heated to their stand, there to remain for hours exposed to cold and wet, and indeed they often have only variations of suffering when taken to the foul, confined stables of the small owners, which I well know are the seats of disease, and commonly the inhabitants of the mews, the first victims of the outburst of epidemics. The wretched existence of the cab horses is soon worn out. The lodgings of the men are commonly of a piece with those of their horses. It is my deep conviction, from observation, that whilst waste is sinful, sin, by the infliction of animal as well as human suffering, is wasteful. Hence economical science will be found to be a more powerful aid to beneficence than is commonly supposed. Mr. Bianconi, the great manager of horses in Ireland, received much applause from religious communities for only permitting those animals under his charge to work six days, that they might rest on the seventh day, but at our section of economic science, at the meeting of the British Association held at Dublin, he frankly disclaimed any other motive than his own interest, which was answered by a saving from the improved practice of 11 per cent. of his outlay for horses. My friend Mr. Whitworth, who has paid much attention to horses, declares that it is more economical to use up two light vehicles (as gigs) and one horse, than two horses and one vehicle. There can be no doubt that good, well-ventilated, and warm stabling for the horses, and better shelter and care during the day, would be economical of capital, as good sanitary dwellings would be to the men. Besides the economical, there are æsthetical considerations connected with this branch of administration; for until the people, high as well as low, have become less apathetic to the constant spectacle in the streets of animal decrepitude and suffering, as well as of human squalor, filth, and wretchedness—until they have become impatient of them and insisted upon their prevention, and upon having in their stead spectacles of wholesome, painless, and pleasant life and action, they are not in a proper state of mind for the reception of due impressions of the beautiful, or of external decorations which the votaries of high art desire to promote. For the achievement of these

improved æsthetical and economical conditions, large capital, as well as a more intelligent and superior public administration, is requisite. On a competition for a large field under the guidance of such an administration, I should expect that the public thoroughfares would be cleared of the cab stands, and the spectacle of the continued waiting of men and horses during inclement weather prevented, and that this would be done by the practice as respects the *voitures de remise*, which prevails in Paris, where in some of the streets only the head of one horse appears from a doorway to a shelter under which it stands ready harnessed, whilst others are in proper stables behind, ready to be harnessed as fast as the demand arises. The considerations of the traffic of a populous district, and of the condition of those engaged in it, would render it desirable to encourage locomotion by steam and the use of tramways through the streets. But judging from experience in Paris and elsewhere, there appears to be no probability of much diminution of the demand for horse-power for the minor traffic of conveyance in populous districts.

"There are large elementary distinctions, which I will mention here, of which I must avail myself on some other opportunity of displaying fully, between charges and payments as for services, and charges on and payments proportioned to the pressure of necessities. Payments as for service imply responsibilities to render that service in a proper manner, and those responsibilities are best brought about, as I may show more fully, by the principle of competition for the field; whilst charges made on necessities, and on estimates of the pressures and means of paying them, are sustained by monopolies, which are incident, and almost essential to the practice of what is called free competition within the field of service. In the case of the New York hackney coachman mentioned by Mr. Ashworth, the coachman, by the agreement with his fellows on the stand, had virtually an irresponsible monopoly of the service, giving him the power to exact payment according to his estimate of the travellers' necessities and means. In the case of a water supply, the actual cost of water for the supply of a water closet would be 6d. per annum if paid for as a service; but as a charge upon necessities or convenience, the companies levy 10s. each per annum, which forms a serious obstruction to the sanitary improvement of towns. And so with the Deal boatmen; and the character of the monopoly is similar, whether it be by the three cabs or the three omnibuses, to do what, under competition for the field, might be the service of conveyance of passengers by two;—or by two or three competing lines of railway, to perform a service which might be more responsibly rendered by one,—or by the seven originally competing establishments for the distribution of water, a service which might be best rendered by one on either side of the river, if not by one for the entire field. The results in these and other branches of service are common efforts and almost common necessities to charge the waste of capital upon the public, to create virtual multiform monopolies, and to impose, for the bad service, high charges exacted on private necessities."

I am, &c., EDWIN CHADWICK.

THE CAB QUESTION.—SIR,—The point that I adverted to in discussing the subject of the present legal cab fares, and their effect in rendering those vehicles of inferior character, has, I find, been misstated in the report of that discussion, given in the Society's *Journal*, where it is stated that I thought "the taxation imposed on cabs was, to a certain extent, compensated by the privilege of standing for hire in public places." Now, it was not the "taxation" on cabs that I referred to in my remarks, but the question of free-trade as bearing on a system of compulsory legal maximum of cab fares; I mentioned that question as being to some extent affected by the fact of cabs possessing the peculiar advantage above stated; but as, owing to the late period of the discussion, I did little more than hint at the point I wished to bring forward, I would now put it more explicitly. Although I quite agree with Mr. Cole that, as a matter of principle, the price of the hire of a cab should be left to be settled between the hirer and the person letting to hire, yet I fear that in practice the leaving this to be arranged between the individuals concerned, without any legal restriction, would be productive of great confusion and litigation; therefore it would seem desirable to consider whether there are not peculiar circumstances attending the matter sufficient to make cab-hiring an exceptional case; these are, that licensed cabs have accorded to them, by public authority, the exclusive right or privilege of standing for hire at certain appointed places in the public streets, and likewise the right of enforcing payment of the fares by a summary process before a criminal judge, which are things not incidental to matters of trade in general; hence it does not seem unjustifiable that these peculiar privileges or advantages should be allowed upon a condition or special public stipulation that the maximum amount of fare should be fixed by the licensing authority—in fact, it is a licence granted on certain conditions. That a compulsory arrangement should enable people to ride in cabs for so small a sum as sixpence is, to my mind, considering all the facts of the case, anything but fair treatment of cabby, and on this point of insufficiency of the amounts at which the fares are fixed seems to hinge the whole question of supply of good or bad cabs, for it is evident the present scale of remuneration is too low to induce capital to enter this field of enterprize. Hence the want of wholesome competition, and the consequent bad condition of the cabs; though, as Mr. Webber remarked, the perils of our crowded streets have possibly something to do with the state of these vehicles, and probably some arrangement for sheltering cab-stands would do something to help us to better cabs. A further point as regards this question of free-trade and cab-fares is, that there does not appear to be any legal obstruction to competition with the cabs in the form of the *Remise* cabs, such as are in vogue in Paris, because there seems to be no law to prohibit such vehicles from being stationed at standings provided by a company or private enterprisers, so long as the riders engage the vehicles at these standings, and not in the public streets. Whether this would be a paying speculation I cannot say, but there seems to be no law to prevent its being tried. I cannot conclude this communication without saying that Mr. Cole appears to me to have deserved the warmest thanks of every one for the able and impartial manner in which he treated the subject.—I am, &c., F. W. CAMPIN.

Temple, Feb. 9, 1867.

MEETINGS FOR THE ENSUING WEEK.

MON.....London Inst., 7. Prof. Pole, F.R.S., "On the Mechanical Structure of the Pianoforte and other Musical Instruments."
R. United Service Inst., 8½. Capt. R. A. E. Scott, R.N., "On the Rolling of Iron Ships in a Sea Way, and its Effects on Naval Gunnery."
Victoria Inst., 8. Mr. Evan Hopkins, "On Terrestrial Changes, and the probable Ages of the Continents."
Entomological, 7.
Medical, 8.
Asiatic, 3.
Society of Engineers, 7½. Discussion on Mr. Thos. Baldwin's Paper, "On Safety Valves."
TUES ...Civil Engineers, 8. Discussion upon Mr. W. H. Barlow's "Description of the Clifton Suspension Bridge;" and (time permitting) Capt. H. W. Tyler, R.E., "On the Working of Steep Gradients and Sharp Curves on Railways."
Statistical, 8. Major-Gen. Balfour, "On the Military Conscription of France."
Pathological, 8.
Ethnological, 8.
Anthropological, 8.
Royal Inst., 3. Prof. Tyndall, "On Vibratory Motion, with special reference to Sound."
WED ...Society of Arts, 8. Mr. Thomas Beggs, "On the Water Supply of London as it affects the Interests of the Consumers."
Meteorological, 8.
R. Society of Literature, 8½.
Geological, 8. 1. Mr. W. Boyd Dawkins, "On the Fossil British Oxen." Part II. *Bos longifrons*. 2. Mr. G. W. Ormerod, "On the Geology of the Upper Part of the Teign Valley." 3. Mr. G. Clark, "Notes on the Geology of Mauritius."
THUR ...Royal, 8½.
Antiquaries, 8½.
Linnæan, 8.
Zoological, 4.
Chemical, 8.
Numismatic, 7.
R. Society Club, 6.
Royal Inst., 3. Prof. Tyndall, "On Vibratory Motion, with special reference to Sound."
FRI .....Royal Inst., 8. Mr. M. D. Conway, "On New England."
SAT .....R. Inst., 3. Mr. G. A. Macfarren, "On Harmony."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 17th August*, 1866.

Victoria, Australia—Further Correspondence relating to the non-enactment of the Appropriation Act, 1865.
Public General Acts—Caps. 58 to 122.

Delivered on 18th August, 1866.

441. Royal Academy—Correspondence.
485. Metropolitan Assessments—Returns.
499. Edinburgh Provisional Order—Sheriff's Report.
514. Irish Society—Return.
527. House of Commons—Return.
530. East India (Army)—Despatches upon the subject of Grievances of Indian Officers.

Delivered on 30th August, 1866.

68. (VII.) Trade and Navigation Accounts (31st July, 1866).

Delivered on 3rd September, 1866.

442. (A. II.) Poor Rates and Pauperism—Return (A).
427. Trade in Animals—Report and Evidence.
454. East India (Engineers' Establishment, &c.)—Returns.
482. Army (Flogging and Branding)—Return
484. Holyhead Harbour of Refuge—Return.
490. Revenue (Ireland)—Return.
498. Municipal Incorporation Act—Return.
501. Whitworth Guns—Return.
503. Petroleum and Shale Oil—Report.
510. Bank Notes—Return.
533. Secretaries of State for War—Return.
Abyssinia (Captives)—Further Correspondence.
Aldershot Camp—Report of the Army Sanitary Committee on the late Epidemic of Scarlet Fever among Children.

Delivered on 7th September, 1866.

160. (VI.) Election Expenses—Return.
322. Savings Banks—Return.
366. (I.) Vicarages and Curacies—Return.
449. Master and Servant—Report, Evidence, &c.
480. Standing Orders of the House of Commons.
481. Army and Militia (Flogging and Marking)—Return.
500. Royal Hibernian Academy—Return.
513. Japanese Currency—Reports.

Delivered on 12th September, 1866.

Public General Acts—Table.

Delivered on 14th September, 1866.

373. (I.) Theatrical Licences and Regulations—Index.
431. Mines—Report and Evidence.
493, 512. British Museum—Correspondence and Communications.
496. Election Petitions—Alphabetical List.
497. Metropolitan Water Companies—Correspondence.
Convict Establishments (Western Australia and Tasmania)—Annual Reports.

SESSION 1865.

473. Taxes Repealed, &c.—Return.

Delivered on 17th September, 1866.

254. Bill—Bankruptcy Law Amendment (as amended in Committee).

Delivered on 18th September, 1866.

Poor Law Board—Eighteenth Annual Report (1865-66).

Delivered on 21st September, 1866.

160. (VII.) Election Expenses—Abstract of Returns.
385. (I.) Writs Registration (Scotland) Bill—Index to Report.
391. (I.) Thames Navigation Bill—Index to Report.
506. Royal Naval Coast Volunteers—Returns.
507. Ship *Favorite*—Return.
520. Roman Catholic Orphanage (Norwood)—Return.

Delivered on 26th September, 1866.

New Zealand—Further Papers.

Delivered on 28th September, 1866.

353. East India (Chinchona Plant)—Return.
379. (I.) Edinburgh Annuity Tax Abolition Act (1860) and Canongate Annuity Tax Act—Index.
406. Friendly Societies—Report of the Registrar.
442. (A. III.) Poor Rates and Pauperism—Return (A).
531. Commons and Open Spaces (Metropolis)—Index to Maps.

Delivered on 2nd October, 1866.

68. (VIII.) Trade and Navigation Accounts (31st August, 1866).

Delivered on 6th October, 1866.

332. (I.) Art Union Laws—Index to Report.
459. Poor Law (Scotland)—Returns.
461. 0.119. Agricultural Customs—Report (of Session 1848 reprinted).
Colonial Possessions—Reports, Part I. West Indies and Mauritius.

Patents.

From Commissioners of Patents' Journal, February 8th.

GRANTS OF PROVISIONAL PROTECTION.

Ammunition lifters and carriages for—85—H. D. P. Cunningham.
Anchors—197—J. C. Haddan.
Artificial fuel—123—D. Barker.
Beton—77—M. Henry.
Blast furnaces—161—W. Clark.
Boots and shoes, lasts for—149—G. M. Wells.
Breech-loading fire-arms and cartridges for—89—W. S. Mappin.
Buoys—3238—F. C. Buisson.
Chimney tops—183—D. S. Chater.
Cigarettes, moulds for making—25—J. Wilkins.
Cotton bale ties—175—W. E. Newton.
Cotton, ginning—153—W. McAndrew.
Differential wheel gearing—125—C. F. Cooke and J. Standfield.
Draughts, &c., preventing—81—J. Hoadly.
Electrical apparatus—177—A. Apps.
Electric telegraphs—181—C. E. Brooman.
Fibrous materials, preparing—173—J. S. Dronsfield.
Fire-arms and ordnance, and cartridges and projectiles for—67—W. B. Robins.
Fire screens, &c.—104—E. B. Taylor and F. Winter.
Furnaces and fire-bars for—75—I. Kendrick.
Gas—73—F. J. Evans.
Gas and water mains, boring and tapping—145—A. Upward.
Guns, breech-loading—191—W. J. Hill.
Guns, projectiles, and cartridges—189—G. Clark.
Hats—185—W. E. Newton.
Heavy bodies, raising, &c.—159—J. Chrétien.
Highways, &c.—91—J. Reilly.
Knitting, looms for—93—W. E. Newton.
Lace—129—C. E. Brooman.
Lamps—137—J. Harding.
Lamps—171—A. Chamberlain.
Lead, separating silver from—87—W. G. Blagden.
Letter-boxes, &c.—169—W. Dennis.
Lingoes—127—E. J. Smith.
Locomotive and marine engines—3406—A. W. Makinson.
Materials, ornamenting, &c.—155—E. Tomlinson.
Materials, tinting—121—W. E. Newton.
Mines, ventilating—117—R. James.
Moulds—139—J. Bate and G. Asher.
Permanent way, packing—83—C. de Bergue.
Photographic transfers—71—A. G. Morvan.
Pipe moulding and casting apparatus—99—W. Clark.
Projectiles, ordnance, and arms—2530—T. Berney.
Pumps—69—E. T. Hughes.
Quays, &c.—79—H. Buss.
Railways, communication between passengers and guards on—3287—A. W. Hosking.
Railway sleepers and chairs—179—L. and E. Thornton.
Railways, permanent way of—115—J. Davies and A. Helwig.
Reaping and mowing machines—107—A. Hill.
Sewing machinery—113—J. Craven.
Sewing machinery—163—J. Northrop, and S. and W. H. Tetley.
Ships—95—R. Atkin.
Ships, propelling—135—R. R. L. Rosoman.
Spinning and twisting machinery—199—G. Haseltine.
Steam boilers—3390—R. Lewis.
Steam boilers, removing scum from surface of water in—15—J. W. Kenyon.
Stoppers—187—F. Hutchinson.
Tanning—131—J. G. Franklin.
Tools, &c., moving and working—105—M. Henry.
Turntables—165—H. Bridgewater.
Vapours, condensing—101—J. M. Hocking.
Vertical furnaces—111—J. Clayton.
Water, purifying—119—E. Süvern.
Weaving, looms for—141—J. J. and E. Harrison.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Eyelets—260—W. R. Landfear.

PATENTS SEALED.

1421. G. J. Vincent.
1776. J. Brotherton.
1903. R. Mitchell.
2070. R. Leigh.
2071. H. Bell.
2072. D. Marchal.
2078. R. Wilson & W. Martin, jun.
2080. W. E. Gedge.
2095. J. Webster.
2237. W. Clark.
2917. E. K. Heaps.
2990. W. R. Lake.
3328. W. R. Lake.

From Commissioners of Patents' Journal, February 12th.

PATENTS SEALED.

2087. S. Alley.
2092. W. Brookes.
2100. W. Shaw and J. Connell.
2101. J. Cameron.
2106. W. C. Gibson.
2108. W. Smith.
2110. G. Payne.
2111. J. Holly.
2118. J. H. Johnson.
2127. J. Varley.
2136. W. Taylor.
2151. J. M. Hyde.
2244. C. D. Abel.
2337. R. A. E. Scott.
2338. R. A. E. Scott.
2465. A. Steven.
2580. J. von der Poppenburg.
3123. A. V. Newton.
3417. W. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

335. J. C. B. Salt.
292. H. E. Drayson.
303. J. C. Dickinson.
331. E. Welch.
320. M. C. de C. Sinibaldi.
343. F. W. Webb.
344. T. S. Cressey.
419. J. Travis.
453. J. Howard, J. Bullough, and T. Watson.
99. S. Blackwell.
325. R. H. Napier.
360. J. H. Johnson.
365. I. Dimock.
380. T. Jackson.
510. J. Robinson.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

367. H. D. Denison.
335. J. H. Johnson.
349. J. C. Lupton & J. Bleasdale.
356. T. W. Rammell.